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Being a neighbor to Syria: A retrospective analysis of patients brought to our clinic for cranial gunshot wounds in the Syrian civil war

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ABSTRACT

Objective: Toward the end of 2010, the Arab spring, the waves of revolutionary demonstrations and protests influenced also Syria, where violent clashes turned into a civil war. Hundreds of thousands of people became refugees. The use of excessive force unfortunately culminated in numerous deaths and injuries in many cities. Being the closest city to Aleppo, Damascus and Homs, the biggest cities of Syria, Antioch/Hatay has been the city where initial emergency treatments were performed. For this reason, we examined and retrospectively analyzed the medical records of the patients treated in the clinics of our hospital due to cranial gunshot wounds during the war.
Material and methods: The medical records of 186 patients who were injured in the Syrian War and brought to, followed up and treated in the Neurosurgery Clinic of Mustafa Kemal University, Faculty of Medicine in Hatay, a Turkish city on the Syrian border, between April 2011 and June 2013.
Results: A total of 186 patients were evaluated in a period of more than 2 years. Of all 91.4% of the patients were adults (male/female: 152/18) and 8.6% of them were pediatric patients (male/female: 14/2). The average age of the patients was 31 years, with an age range of between 2 months and 67 years. According to Glasgow coma score (GCS) of the patients at the time of admission, GCS was 3 in 32 patients (17.2%), between 4 and 7 in 70 patients (37.6%), and between 8 and 15 in 84 patients (45.1%). We observed that the patients with GCS of 4–7 had a significantly lower mortality among the 56 patients treated surgically compared with the 14 patients treated medically.
Discussion: Cranial gunshot wounds are responsible for high mortality and morbidity. A multiplicity of factors plays a role on morbidity and mortality. These are the duration of transport, the injury pattern, the velocities of the weapons used, and the Glasgow Coma Scales of the patients at the time of admission.
Conclusion: The authors recommend that the patients with cranial gunshot wounds who has GCS of 4–7 should be aggressively treated including surgery as well. We do not recommend surgical treatment for patients with GCS of 3. All our experiences show that treatment of gunshot wounds will continue to be a matter of debate, about which there is more to learn. The data presented in this study will once again demonstrate the seriousness of the event, and will, perhaps, contribute to the peace negotiations to end the war.

1. Introduction

As war injuries do not only affect soldiers but also civilians, it continues to be a common social problem. Since 1945, more than 100 million people were affected and more than 25 million people were killed in military conflicts worldwide. Considerable developments have been recorded as regard the basic principles for the management of gunshot wounds and neurotraumas caused by wars since the beginning of this century. The experiences from the Korea, Vietnam, Israel and Gulf wars have been the basis of treatment management of patients as a result of conflicts in different parts of the world. Cranial gunshot wounds are again a matter of discussion due to high mortality and morbidity rates which still prevail today.

Tissue damages caused by craniocerebral gunshot wounds generally occur in 3 ways: direct effect or crush, shock waves and transient cavitation [1]. The energy that comes out in injuries caused by low-velocity bullets generally causes compression and

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laceration with direct impact on tissues adjacent to the bullet course. In case of injuries caused by high velocity and very high velocity bullets, shock waves and cavitation occur. The damage caused by bone fragments like a second bullet is heavier than the damage caused by the bullet itself [2]. When the bullet hits and enters the tissue, it forms pressure in the site and spreads transient shock waves, causes damage in the distant tissues along the bullet course, and may form temporary neurological deficits which may recover in time. Shock waves are reflected just like the sound waves. When the bullet enters a tissue, the tissue moves both forward and sideways. Hence, a transient cavitation occurs in the site. The volume of this cavitation is correlated with the velocity, mass and shape of the bullet. The cavitation may be approximately 20–30 times wider than the diameter of the bullet. The limited intracranial elasticity increases the injury that occurs in the tissues during the formation of cavitation. The cerebral tissue is squeezed between the tentorium and the falx, and an effect similar to the compartment syndrome occurs. The injury is aggravated with the penetration of bone fragments into the cavitation, but these bone fragments are rather a source infection [3].

Military gunshot wounds involve a higher velocity than civilian injuries (>2500 ft/s). The degree of the primary damage that occurs is related to the velocity and mass of the object ($E = 1/2mV^2$). The amount of energy is the entry velocity and mass of the bullet minus the exit velocity and mass of the bullet divided by 2, i.e. $E = M_1V_1 - M_2V_2$; in this calculation, the configuration, design and composition of the bullet or missile has been ignored. The spin of the bullet is related to kinetic energy [4]. Because cranial gunshot wounds in civilian life are caused by small caliber and low velocity bullets, they do not result in wide scalp destruction. As a result, most surgeons rather prefer the conservative approach in low velocity injuries [5,6].

The fast development in the weapon technology brings together a diversity of mortality rates and injury patterns. There is more to learn about this issue since it is not possible to make a comparison of the information received from regions of conflict. Today, a true consensus has not been reached yet because of different opinions and policies about the treatment algorithm of cranial gunshot wounds, whether civilian or military.

In this study, our objective is to carry out a retrospective analysis of the patients admitted to our hospital for cranial gunshot wounds during the Syrian civil war and to share our experience.

2. Material and methods

2.1. Patient population

The evaluation was carried out on 186 patients who were injured in the Syrian War and brought to, followed up and treated in the Neurosurgery Clinic of Mustafa Kemal University, Faculty of Medicine in Hatay, a Turkish city on the Syrian border, between April 2011 and June 2013.

The physiopathology of the injuries, clinical findings, injury patterns (penetrating, perforating, tangential and superficial) and injury types (blunt trauma, bullet injury, shell fragment injury, mine injury, bomb, missile and blast) were investigated. For all patients, age, gender, Glasgow Coma Score (GCS), time to arrival at the hospital, Glasgow Outcome Score (GOS), CT images, cranial pathologies, postoperative complications, mortality and morbidity rates and surgical methods were evaluated.

2.2. Statistical analysis

SPSS software program version 13.0 was used for statistical analyses. Descriptive statistics were stated as percentage, mean ± SD (standard deviation) and number. Chi-square/Fischer's test was used for comparisons between categorical variables. Significance was accepted if p value was less than 0.05.

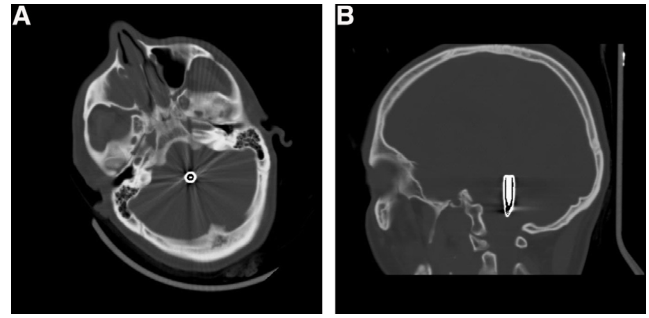

Fig. 1. (a and b) Axial and sagittal CT image showing penetrating injury due to a gunshot wound in a 26-year-old man.

3. Results

A total of 186 patients were evaluated in a period of more than 2 years. Of these, 91.4% were adults (male/female: 152/18) and 8.6% of them were pediatric patients (M/F: 14/2). The age of victims ranged from 2 months to 67 years with an average of 31 years. The pathologies seen in the pediatric group of patients were injuries caused by bombs that exploded nearby. In terms of injury types, 126 patients (67.7%) had shell fragment injuries and 60 patients (32.3%) had suffered from bullet injuries (Fig. 1). In terms of injury patterns, 83 patients (44.6%) showed penetrating injuries, 45 patients (24.1%) had injuries crossing both hemispheres at any plain, 28 patients (15%) had tangential injuries, 12 (6.4%) had perforating injuries, 4 (2.1%) patients had injuries from ricocheting bullets, and 14 (7.%) had superficial injuries (Table 1). According to admission GCS of the patients, GCS was 3 in 32 patients (17.2%), between 4 and 7 in 70 patients (37.6%), and between 8 and 15 in 84 patients (45.1%). In terms of the duration from time from injury up to admission by our center, 22 patients (11.8%) arrived in the first 2 h, 135 patients (72.5%) arrived in between 2 and 24 h, and 29 (15.5%) patients arrived in between 24 h and 5 days. The reason why the arrival of the patients delayed up to 5 days was to wait for a safe time to cross the border.

3.1. Radiological findings

Cranial CTs of all patients were taken, and were classified according to cranial pathologies (Table 1). The cranial pathologies of the patients were more than one when evaluated according to lesion type. For that reason, when surgery was performed on a patient, different lesions were also treated. The lesions shown in Table 1 are not purely a single type of lesion, but a combination of more than one type of lesion. There were intraparenchymal bone fragments in 80 patients (43%), compression fractures in 58 patients (31%), and hemorrhage on the transventricular bullet course in 45 (24%) patients. While these pathologies represented the highest rate, there were also subdural hematoma, epidural hematoma, intraventricular hemorrhage and combination of these lesions in our patients. There was a blast effect in 1 patient, for whom GCS was taken as 7 due to the effect of the bomb which exploded at a very close distance. No pathologic lesions were found in the cranial CT and MRI of this patient. The patient died 24 h later. No intracranial pathology was detected in the autopsy and pathological examination of this case.

Table 1
Clinical data of 186 patients with cranial gunshot wounds.

		n	%	*p*
Sex	Adult (M/F)	152/18	91	0.683[a]
	Pediatric (M/F)	14/2	9	
Injury type	Penetrating	83	44.6	0.0001[b]
	Cross-over hemispheres	45	24.2	
	Tangential	28	15.1	
	Perforating	12	6.5	
	Bounced bullet	4	2.2	
	Superficial	14	7.5	
Radiological findings	Intraparenchymal bone fragments	80	43.5	0.0001[b]
	Depression fracture	58	31.5	
	Transventricular hemorrhage	45	24.5	
	Blass effect	1	0.5	
Operative technique and intraoperative findings	Conservative surgery	98 88	53 47	0.463[b]
	Decompressive craniectomy + implanting bone flap into abdomen	38	43	
	Removal bone& metal fragments + hematoma removal	36	40	
	Duraplasty for parenchymal prolabbing & CSF fistula	14	16	
	Re-operation related with complications	8	9	

A *p* value of <0.05 was considered significant.
[a] Fisher's exact test.
[b] Chi-square test.

Table 2
Survival with respect to treatment type.

	GCS	Survey			Total (*n*)
		Live, *n* (%)	Death, *n* (%)	*p*[a]	
Surgery	3	0 (0%)	5 (100%)	0.0001	5
	4–7	44 (78.6%)	12 (21.4%)		56
	8–15	27 (100%)	0 (0%)		27
					88
Conservative	3	0 (0%)	27 (100%)	0.0001	27
	4–7	3 (21.4%)	11(78.6)		14
	8–15	53 (93%)	4 (7%)		57
					98

GCS: Glasgow Coma Score. $p < 0.0001$ compared the patients with GCS = 4–7 in surgical and conservative treatment groups.
[a] Chi-square test.

3.2. Admission GCS

As the basic criteria in deciding surgical treatment of patients, we used admission GCS. GCS was 3 in 32 patients (17.2%), between 4 and 7 in 70 patients (37.6%), and between 8 and 15 in 84 patients (45.1%). Surgical treatment was applied to 5 out of 32 patients with GCS = 3, 56 of the 70 patients with GCS = 4–7, and 27 of the 84 patients with GCS = 8–15. Surgical treatment was applied to 88 patients in total (Table 2). Of the 98 patients, in whom the conservative approach was used, CGS was 3 in 27 patients, between 4 and 7 in 14 patients, and between 8 and 15 in 57 patients. Intracranial pressure (ICP) monitoring was performed in 6 of 14 patients who had high intracranial pressure due to their pathologies and those with GCS between 4 and 7, and in 12 of 32 patients whose GCS score was between 8 and 15, and this procedure was followed by cerebrospinal fluid (CFS) drainage to measure and reduce pressure. The catheter was removed after ICP was lowered.

3.3. Intraoperative findings and operative technique

Surgical treatment was used in 88 (47.3%) of the 186 patients, whereas conservative treatment was used in 98 (52.7%) of the patients. Of the patients who underwent surgical treatment, 38 (43.1%) were underwent decompressive craniectomy and bone flap placement in abdomen, 36 (40.9%) were applied removal of bone fragments + removal of metal parts + hematoma drainage (intraparenchymal and extraparenchymal), 14 (16%) patients were applied duraplasty for parenchymal prolapsus and CFS fistula (Table 1). Four types of craniectomy were employed in decompressive craniectomy: frontotemporal, frontotemporoparietal, bicoronal and suboccipital. The extracted bone flaps were placed in the left lower quadrant of abdomen. The reason why the left lower quadrant was preferred was percutaneous endoscopic gastrostomy which might later be needed as the treatment of these patients lasted long. In patients who underwent duraplasty, fascia lata graft was preferred because galea graft was contaminated and could result in secondary infections. Eight patients (9%) who underwent surgery were re-operated due to various complications.

3.4. Complications

In 3 surgery patients, CSF fistula developed, and 2 of these patients were treated with lumbar external drainage and 1 patient was re-operated with duraplasty. Meningitis was observed in 4 patients, of which 3 were in the conservative treatment group, and 1 was in the surgical treatment group. All patients were administered medical treatment and showed recovery. Furthermore, intracerebral abscess was found in 3 patients, who were re-operated. Of these one patient was diagnosed with recurrent abscess and operated for the 2nd time, and recovered. Eleven patients developed systemic complications. Loss of scalp tissue was detected in 4 patients, and these were operated by a plastic surgeon for

scalp repair. Surgical site infections developed in 5 patients. These patients were treated with appropriate antibiotics and debridement. Epileptic seizure was seen in 4 of the patients who were administered conservative treatment and 3 patients who were applied surgical treatment, and were cured with medical treatment.

3.5. Mortality rates

Fifty-nine of the 186 patients (31.7%) died. In regard to distribution of the patients who died, in the surgical treatment group, all the 5 patients who had a GCS of 3 (100%), and 12 of the 56 patients who had a GCS score of 4–7 (21%) died, and severe respiratory distress developed in 3 of these patients. None of the 27 patients who had a GCS of 8–15 died. Eighteen of the 59 patients who died were accompanied by multi-systemic injuries. In the conservative treatment group, all the 27 patients who had a GCS of 3 (100%), 11 of the 14 patients who had a GCS of 4–7 (78.5%), and 4 of the 57 patients who had a GCS score of 8–15 (7%) died. As it is seen, there is a statistically significant difference between the mortality rate in the surgical treatment group and the mortality rate of the conservative treatment group, given the rates of surgical and conservative patients who had a GCS of 4–7 ($p < 0.001$).

3.6. Glasgow Outcome Scale (GOS)

The discharge of the patients from the hospital was based on GOS [7]. The GOS scores of the surgical and conservative treatment patients were presented in Fig. 2. Among our patients who showed a good recovery, 26 were in the surgical treatment group, and 10 were in the conservative treatment group. In the conservative treatment group, patients who had a GOS score of 5 had bomb shell injuries and had a GCS score of 8–15. Among the patients in the surgical treatment group who had a GOS score of 5, 11 patients had bomb shell + bone fragments, 8 patients had compression fractures + bomb shell fragments, and 7 patients had intracerebral hematoma. Among the patients who had a GOS score of 2, 7 patients in the surgery group had transventricular lesions, whereas 3 patients in the conservative treatment group had bullet injuries.

4. Discussion

4.1. Injury pattern

The developments in weapon and protective system technology bring together different patterns of injury. During the Vietnam War the balance between bomb shell injuries and bullet injuries shifted toward the bullet injuries [8]. However, injuries caused by bomb shells were predominant among deaths that occurred during the other wars [9,10]. Carey [11] reported a ratio of 95/5% with regard to bomb shell injuries and bullet injuries. Burkle et al. [12] found a ratio of 84/10%. However, during the Iraq war, the ratio of soldier injuries by bomb shells/bullets rose from 37% [13] to 39% [14]. Lakstein [15] found comparable results such as 15% in bomb shell injuries and 64% in bullet injuries for Israeli soldiers in the Lebanese war in 2003. In our patients, the ratio of bomb shell/bullet injures is 67.7/32.3%.

Brandvold et al. [16] reported 16% penetrating injuries and 9% tangential injuries during the Israel–Lebanon conflict in 1982. In the Vietnam War, 20% of the patients with severe penetrating wounds died immediately after admission before any surgical intervention could be performed. Ten percent of the remaining 80% were mortal. During the Iran–Iraq war between 1980 and 1988, penetrating, tangential and perforating injuries were reported to be 55.7, 22.4, and 7.47%, respectively [17]. In the presented series, the rates of penetrating and tangential wounds were 45 and 15%, respectively. As it is obvious, the penetrating wound rates are higher during wars. In fact, it is hard to compare wars since pieces of information are selected from random groups. In our opinion, the developing weapon technology results in more deaths due to this type of injury.

4.2. Injury time

Delayed patient transport raises the mortality rate. Mortality rate which was high in the World War I and World War II dropped during the Vietnam War as a result of faster transport [4]. In our series, 11.8%, 72.5% and 15.5% of the patients were brought to our center within the first 2 h, in between and 24 h and in between 24 h and 5 days, respectively. Patients brought in the early stage were wounded in conflicts near the Turkish border. The delays in the transport period occur rather because of having to wait for a safe time to cross the border, or using different methods to cross the border. The time to care for craniocerebral firearm injuries is of course effective on mortality rates. Secondary damages that occur are more severe than the primary damage. However, we do not express any ratio for the relationship between the intervention time and mortality rate since we do not have any data as to the number of people who got wounded at the conflict site and the fate of the wounded.

4.3. GCS

GCS is the most important indicator for us in terms of operation indication. Grahm et al. [18] reported that surgery should not be employed in patients with a GCS score between 3 and 5 unless there is an operable hematoma, and patients with a GCS score above 8 must be treated aggressively. Suddaby et al. [19] determined that in a series of 43 civilians wounded by 22-caliber guns, no mortality was seen in those with GCS >12, and mortality was seen at 85% in those with GCS <7, and the patients who had fixed pupils at the time of admission all died. Suddaby et al. do not recommend surgical treatment in patients with a GCS score of 3 and who have fixed and dilated pupils. Cavaliere [20] operated only patients with GCS >6. Carey [21] who carried out a comprehensive review of the literature suggested that no surgical treatment must be applied to those with a GCS between 3 and 5, and a selective policy must be employed in those with a GCS between 6 and 8 although mortality rate was 50%. However, Stone et al. [22] recommend surgery so long as pupil reaction exists and the patient is hemodynamically stable even though GCS score is 3. Patients in whom a mass effect associated with hematoma is detected clinically or through radiology must immediately undergo surgery. However, in our series, 5 patients with GCS = 3 were operated on because of they had reacting pupil to light and were hemodynamically stable on admission. Unfortunately, all of these patients died. Stone et al. [22] stated that patients without hypotension and with a GCS score between 4 and 7 must immediately undergo surgery so long as they have motor responses, even if their pupils are fixed and dilated, and patients with a GCS between 8 and 15 must be operated until no abnormality remains on CT.

When deciding about management, the brain surgeon must take into account the age of the patient, clinical condition and CT findings. In the light of the proofs mentioned above, when a patient, who has a GCS between 3 and 5 and pupil responses, is concerned, a CT must be taken if he/she has no hypotension after resuscitation. If the CT scan does not indicate any bad survival or high mortality risk, the patient must undergo surgery. Surgery increases survival in such patients. Most brain surgeons have reached a consensus on the following issue; only supportive therapy must be administered to patients who are wounded with high velocity firearms or low velocity firearms fired at a short distance, or in deep coma, have

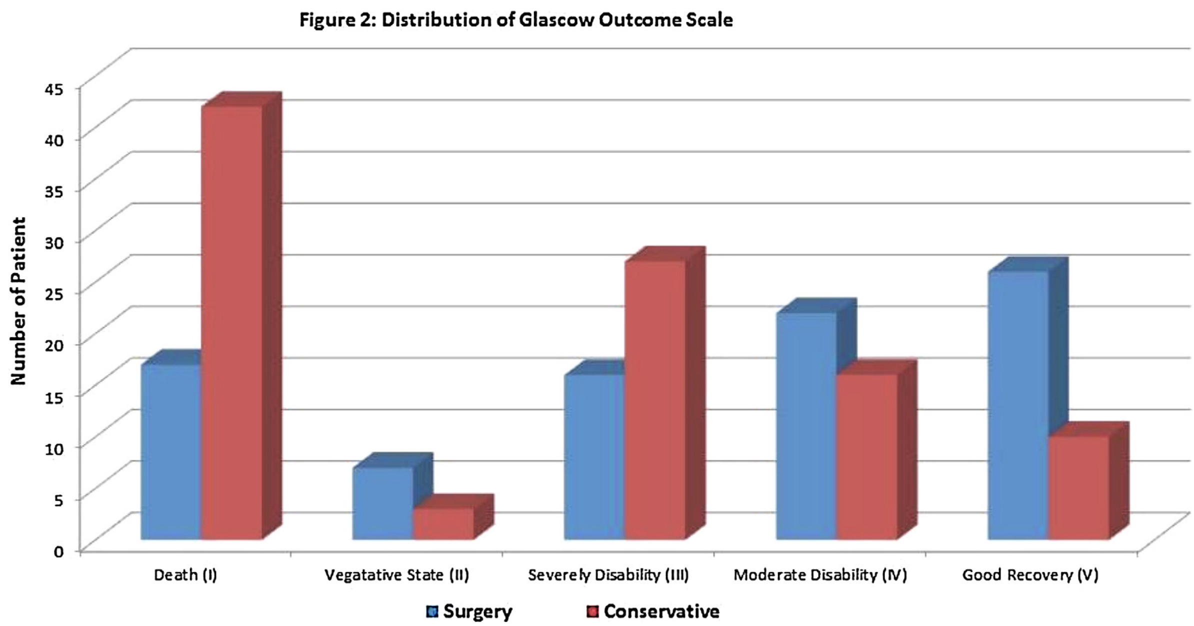

Fig. 2. Distribution of Glasgow Outcome Scale.

bilateral fixed and dilated pupils, gross bilateral brain, brain stem or posterior fossa wounds, and fatal trauma observed on CT.

In the light of our experiences, there is no significant difference between conservative treatment and surgery, since both treatments end up with 100% mortality when GCS is equal to 3, whether pupils are fixed or not, even if there are surgical findings on CT. However, there is a statistically significant difference in terms of mortality between the aggressive surgical approach and the conservative treatment in patients with a GCS between 4 and 7 ($p < 0.001$). In case of patients with a GCS between 8 and 15, if there is any surgical indication, surgery must be considered for a better life comfort and to prevent complications likely to develop.

Further comprehensive multi-center prospective studies (preferably randomized) should be implemented to review the benefits of aggressive medical and surgical therapies and the surgical indications of patients with GCS between 3 and 5.

4.4. Complications

Brain abscesses mostly develop around bone fragments within 3–5 weeks in 90% of the cases, but may develop years later in some of the cases. Most bullet tracts are not often/highly contaminated after the injury, but this possibility may increase if the interval between injury and neurosurgical treatment extends [21,23]. Thus, the timing of surgery is important to avoid postoperative infections. Infection risk is much higher in the presence of bone fragments which are omitted/are not removed; in particular, if the scalp is torn, complete scalp closure becomes important [24,25]. Brain abscesses are more frequent around metallic fragments. However, metallic fragments may remain as sources of infections over the years. Metallic fragments may travel/move to cause further damage. Others reported that there is no correlation between omitted/left fragments and brain abscesses; thus a limited surgery which will protect live cerebral tissue is recommended [16,19,26,27]. In the presented series, intracerebral abscess developed in 3 patients, and surgical treatment was employed. The abscess was located around bone fragments and metal parts, and had a quite hard capsule. In our experience, if surgery is to be employed, such pieces must be removed, otherwise, they must be monitored for a long term. In combined series, the rates of seizure after firearm injury vary between 1.3% and 24% despite the nature of bulled damage and use of prophylactic anticonvulsants [28]. Due to the effects of iron on the brain, omitted//left metal fragments might have a higher epilepsy risk.

4.5. Mortality

After resuscitation, GCS is one of the important prediction tools related to the outcome. Survival after firearm injuries in the head is directly related to GCS [22,29,30], and the survival rates are 3, 52, 92, and 100% in individuals with GCS between 3 and 5, GCS between 6 and 8, GCS between 9 and 12, and GCS between 13 and 15, respectively. When multiple series are combined in a single pool, survival rates in civilian injuries caused by firearms were 8.1, 35.6 and 90.5% in patients with a GCS between 3 and 5, between 6 and 8, and between 9 and 15, respectively. In other series, no survival was seen in patients with a GCS of 3 or 4. Siccardi et al. [31] reported that none of the 7 patients who had a preoperative GCS score of 4 and 5 survived, and 4 of the 12 patients who had a preoperative GCS between 6 and 8 and a bad postoperative outcome survived, whereas 70% of the patients who had a preoperative GCS between 6 and 15 survived after surgery, and 73% of the survivors sufficiently healed. Grahm et al. [18] reported that in a series of 100 patients wounded by firearms in the head no satisfactory results were obtained in any of the patients who had a GCS score between 3 and 5 despite aggressive management protocols. Aldrich et al. [32] reported that in a series of 151 cases with severe head trauma caused by firearm injury (comateous) the overall mortality rate was 88%, whereas mortality rate for GCS between 3 and 4 was 94% and mortality rate for GCS between 6 and 8 was 70%. Moderate recovery was noticed in 3 cases with GCS <8 and good results were not observed. Hernesniemi et al. [33] reported 22% mortality in patients who were conscious on admission and 93% mortality in patients who were unconscious on admission due to firearm injury in the head. Stone et al. [22] reported that post-resuscitation GCS was the most important/significant predictor for the results. Surprisingly, in these series, surgery was employed in patients with a post-resuscitation GCS score of 3, and 2 patients showed good recovery. Fourteen percent of the patients with a GCS of 3 or 4 survived despite undesired results in significant numbers. In the

presented series, none of the patients with a GCS score of 3 survived. Five patients who underwent surgery and 332 patients who were administered conservative therapy died. In patients who had a GCS between 4 and 7, the mortality rate was 21% in patients who underwent surgery, whereas the mortality rate was 78% among patients treated with the conservative approach. In patients with a GCS between 8 and 15, no fatality occurred in the surgical treatment group, whereas 4% mortality occurred in the conservative treatment group. As it obvious, survival rate increases with the increasing GCS. Our results were presented in Table 2 and the results were consistent with the literature except surgically treated patients with GCS 4–7.

4.6. Surgical principles

The surgical principles implemented in head injuries caused by firearms are debridement of devitalized tissue, drainage of hematoma which causes mass effect, removal of bullet and bone fragments that can be reached, minimal local debridement, sensitive hemostasis, watertight dural closure (if necessary with patch graft), and postoperative intracranial pressure control. Wide spectrum antibiotics, anticonvulsants and tetanus prophylaxis should also be used [29]. The degree and necessity of debridement is disputed. It is difficult to describe the effect of surgical aggressiveness on mortality; it depends on the preoperative neurological state of the patients, but, maybe it is much more dependent on the effects of complications. Stone et al. [22] recommended a more aggressive approach to the debridement of the devitalized tissue to reduce edema, and suggest irrigation to wash bone fragments and debris. Debridement is particularly important for the temporal lobe and cerebellum. Ultrasound was found useful in these cases to localize bone fragments and hematoma. According to the counter views, wide irrigation or debridement of the bullet tract is not necessary; only debridement of the entrance and exit wounds, and removal superficial bone fragments are necessary, and no re-operation is required for the remaining bone fragments [16,25,27,34]. On the other hand, Ragel et al. [35] recommended wide craniectomy, sufficient brain stem decompression and minimal debridement. Our experience, with this series, was to use wide decompressive craniectomy and debridement to the extent possible, and aggressively removal of bone fragments and metal parts.

The factors accompanying the bad outcomes in firearm injuries in the head include a GCS of 3 on admission, subarachnoid bleeding on CT, intracerebral hematoma, ventricular injury, intraventricular hemorrhage, multilobar or bihemispheric injury accompanied by diffuse fragmentation, bullet crossing/covering the geographical centers of the brain, hypoxia, and hypotension on admission [20,30,36]. In case of patients who have craniocerebral firearm injuries, fast transport to major trauma centers is essential, and there is a reverse relationship between time of arrival at the emergency service and survival. Most of the patients have increased intracranial pressure, hence, early intubation, aggressive resuscitation and ICP monitoring are recommended.

4.7. GOS and prognosis

The most important approach in evaluating the results is not mortality in time, but the functional level of the patient. Some analyses on the survivors are reported according to their functional levels. The combination rates of “good recovery” and “moderate disability” groups extend from 63% to 92% [18,33,37,38]. In our series, this rate is 58%. The combination rate of the vegetative state and severe disability groups is 41%. The functional recoveries of the patients tend to improve in time, but Ewing-Cobbs et al. [37] found that GOS was considerably stable in time in small series of children who had cerebral firearm injuries. Stone et al. [22] reported improvement in 48% of the patients, and aggravation only in 6% of the patients. Nine of the 16 “disabled” and “dependent” patients showed improvement in functional state (GOS 4 and 5) (Fig. 1).

5. Conclusion

Our experience as a result of this war shows that early intubation, aggressive resuscitation and GCS score are important factors for survival. The time of arrival has great importance on mortality. Despite the diversity of views in the literature, patients with GCS of 4 and above should be operated if surgical pathologies exist, and decompressive craniectomy must be wide. If the removed bone flaps are to be placed in abdomen, the left lower quadrant could be preferred. If duraplasty is necessary, fascia lata could be preferred considering the possibility that the galea may be contaminated. In craniocerebral firearm injuries in war, there are several factors affecting mortality. For that reason, we suggest that it may be appropriate to consider GCS as the basic criteria in assessments. However, there is one thing we can be certain of, which is that we should not consider the 186 cases discussed in this study only as quantitative data, but also we should think of the hundreds of thousands of people who remain behind and whose lives will never be as before.

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